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Discriminative Parental Solicitude: A Biological Perspective*

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The problem addressed in this paper is variability in the quality of parental care. Situational determinants of this variability are considered within the framework of evolutionary theory. Parental behavior in people and animals is discussed from this perspective, with attention to parental attachment, child abuse and neglect, parental sex differences, adoption, and differential treatment of one's children.

The quality of parental care varies, not just between parents, but within individual parents too, between children and over time. Some children are adequately nurtured while others are neglected and even episodically abused. In studying variables related to the risk of child abuse and neglect, we have been led to consider variations in parental solicitude more generally.

Abuse and neglect of children are not rare. In the United States in 1976, for example, 99,579 alleged cases of child abuse and neglect were reported to the American Humane Association from states representing 45 percent of the U.S. population and 47 percent of these allegations were confirmed (*National Analysis of Official Child Abuse and Neglect Reporting*, 1978). Indeed, children have been the subject of parental abuse and neglect throughout history and in a variety of cultures (Thomas, 1972; Dickeman, 1975; Langer, 1974). Researchers have shown socioeconomic, psychopathological and developmental factors to be relevant to the probability of such behavior (Gil, 1970; Martin, 1976; Helfer and Kempe, 1976; Parke and Collmer, 1975; Parke, 1977). It is increasingly clear, however, that such factors cannot explain all cases, and that the capacity for parental maltreatment is widespread in otherwise "normal" adults.

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Why is such inhumane behavior so prevalent? In this paper, we will argue that a partial answer to this question is to be found in evolutionary biology. Mistreatment of the young occurs throughout the animal kingdom under circumstances which are analogous to those prevailing in many cases of child abuse and neglect. Recent studies of human and animal behavior support a developing body of evolutionary theory about why adults are sometimes nurturant and sometimes abusive toward young.

We feel it important to stress at the outset that we are not setting up evolutionary explanations of behavior as alternatives to explanations in terms of developmental or socioeconomic factors. We consider these to be complementary levels of explanation (Daly and Wilson, 1978). The behavior of a mother nursing her infant, for example, is, on the one hand, to be understood as the result of a process of evolution by natural selection, whereby maternal behavior and the needs and abilities of the infant are in harmony. The same behavior may also be "explained" in terms of social, physiological and other processes in the mother's development. Her socioeconomic class may also be a predictor of the decision to breast-feed and hence be part of the explanation of her behavior. Neural and hormonal mechanisms might be invoked too. None of these "explanations" precludes the others. Similarly, our proposal of an evolutionary rationale for the occurrence of variations in parental solicitude in no way denies the validity of explanations at other levels. (We refer interested readers to

several recent contributions on the relevance of evolutionary theory to human behavior: Alexander, 1974; Barash, 1976a; Chagnon and Irons, 1979; Alexander and Tinkle, in press).

EVOLUTIONARY FRAMEWORK

Not long ago, popular accounts of animal behavior often asserted that nonhuman animals rarely or never kill or maim members of their own species. They were wrong. Recent literature abounds with examples and discussions of intraspecific mayhem (Fox, 1975; Hrdy, 1974; Sherman, in press). The new emphasis reflects a new theoretical perspective. Evolution was once imagined to produce organisms whose highest goal was "the good of the species"; biologists with this view were likely to ignore evidence of murder or to consider it a pathological consequence of abnormal circumstances. More recent theory, however, has stressed that evolution by natural selection is a process of competition among members of a species, and that selection can sometimes favor ruthless competitive behavior.

Natural selection is a process of differential reproduction. One's ancestors might include the strong and the weak, smart and stupid, timid and aggressive, but every ancestor of every living creature was alike in this regard: he or she reproduced successfully. Reproductive success is the single ultimate currency by which natural selection measures an organism's success. Certain attributes promote reproductive success, whether directly, as in the case of effective mate attraction displays, efficient nest-building, and so forth, or indirectly, as in the case of feeding efficiency, predator detection, and so forth. Such attributes, insofar as they are heritable, tend to supplant less successful alternatives over generations; this *is* natural selection. The result is that the behavioral tendencies which are optimal for maximizing an individual's reproduction become characteristic of the population. For example, the intervals between births which characterize any slow-breeding mammal (such as humans) under natural conditions are evidently optimal for the maximal lifetime reproduction of healthy, mature offspring (Daly and Wilson, 1978).

From this perspective, organisms may be considered to have "strategies" for maximizing reproduction. This convenient meta-

phor carries no implication of conscious intent. Animals must allocate time and energy to a variety of activities such as feeding, courtship and parental care, and their solutions to this "budgeting" problem approach optimality as a result of natural selection (*e.g.*, MacFarland, 1977). Which budget constitutes the best strategy for any particular species varies, depending in part upon ecological factors and the species' characteristic social organization.

In the case of reproductive behavior, theorists have developed the strategy metaphor by considering animals to have a limited quantity of "reproductive effort" to expend. How to budget that effort involves several "decisions": how many young to have at a time, for example, or how to space them. Two very basic decisions involve how much effort to devote to parental care (as opposed, for example, to the pursuit of a maximal number of matings), and how to allocate that care among offspring.

In most animals, and especially in mammals, females commonly allocate more reproductive effort to parental care than do males, who instead compete among themselves for opportunities to inseminate females. A male's reproductive success is often a direct function of the number of mates he acquires. A female, by contrast, has a lower reproductive ceiling imposed by her limited capacity to nurture offspring. One male is generally enough to sire all the young she can raise, so that a female cannot benefit reproductively from multiple mates in the same way that a male can. Therefore, distinct reproductive strategies may characterize the sexes within a single species (Trivers, 1972).

In most mammalian species, males play no parental role, but there are exceptions, including ourselves. A necessary condition for the evolution of a male strategy which includes parental care is some degree of *paternity confidence*: the young for whose welfare a male invests his reproductive effort should be his own. Any behavior which risks misdirecting parental care to unrelated young is maladaptive evolutionarily, promoting the reproductive success not of oneself but of one's rivals. Males have evolved various tactics to avoid such misdirected parental investment, including uninterrupted consortship with the mate (as in gibbons, see Ellefson, 1974), the rejection of females who may already have

been inseminated by another male (as in doves, see Erickson and Zenone, 1976), and abrupt termination of parental investment and desertion of the mate upon receipt of evidence of possible cuckoldry (as in bluebirds, see Barash, 1976b).

Natural selection has similarly inclined females to invest only in their own offspring. In mammals, under natural conditions, *maternity confidence* is generally more easily attained than paternity confidence, since females acquire individualized bonds with their own offspring at birth, and are at low risk of misdirecting parental care. The attachment process can be disrupted experimentally, however. In goats, for example, one may substitute an alien young within the first hour postpartum and dupe the mother into accepting it (and rejecting her own kid, Klopfer, 1971).

DISCRIMINATIVE PARENTING

Parental feeling is not indiscriminate. A nanny goat nursing her own infant may brutally reject a strange kid's approaches. A gull, solicitously brooding and feeding its own chicks, may cannibalize unattended young in an adjacent nest. In fact, parental solicitude appears to be discriminatory or not according to whether natural circumstances are such that parents are exposed to unrelated young and are therefore at risk of misdirecting their care. Only where such risk exists does natural selection promote the evolution of discriminative capacities. Among birds, for example, individual recognition of eggs and chicks is well developed in species like guillemots that breed in dense aggregations, and is absent in related species with dispersed nesting sites (e.g., Birkhead, 1978). Furthermore, such parental discrimination commonly develops at just that stage of the young's developing mobility when mix-ups become a possibility. Female flying squirrels, for example, will accept artificially introduced alien pups up to 40 days postpartum, when young become capable of leaving the tree-hole nest; after that age, strange juveniles are attacked (Muul, 1970).

Beyond a parent's concern to avoid squandering valuable reproductive effort on someone else's offspring, there are several reasons why it may be adaptive to attack and even kill unrelated young. Some crows derive a significant proportion of their own nourishment

from cannibalizing others' chicks (Yom-Tov, 1974, 1975). Parents may also help their own young by clearing the area of potential competition for food and other resources. This seems to be the principal reason why rabbit does kill strange juveniles (Mykytowycz and Dudzinski, 1972), and why breeding female ground squirrels sometimes attack their neighbors' litters (Steiner, 1972). Finally, it sometimes benefits an immigrant male's reproductive success to kill a female's nurslings, thus terminating her lactation and hastening her physiological readiness to breed with him; such infanticide is common in lions (Bertram, 1975) and monkeys (Hrды, 1974; Angst and Thommen, 1977). Similarly, male lemmings have recently been shown to kill the young of strange females while tolerating litters they sired during previous brief cohabitation with the mothers (Mallory and Brooks, 1978).

A common view of parental motivation sees mothers as hormonally primed for solicitude and infants as potent stimuli for eliciting maternal responsiveness. In physiological investigations, primarily using rats as subjects, a generalized maternal state has been measured without regard to the individual identity of pups (e.g., Rosenblatt, 1975; Stern and MacKinnon, 1976). But, if rats are remarkably indiscriminate in their responses to young conspecifics, other species are not, being simultaneously capable of strong maternal responsiveness to their own young and aggression to like-aged aliens. The control mechanisms of parental care have been selected to serve the reproductive interests of individual parents. Discriminative attachment and ruthless treatment of alien young have evolved in various forms, wherever they help parents raise more of their own offspring to maturity.

REPRODUCTIVE STRATEGIES IN HOMO SAPIENS

The evolutionary perspective which views organisms as "strategists" whose ultimate goal is reproduction can usefully be applied to human beings. Although human behavior varies considerably among cultures, generalizations can be made. We have elsewhere discussed cross-culturally consistent aspects of the relationship between women and men, arguing that a number of facts about mate se-

lection, marriage laws, and concern with spousal fidelity match expectations from evolutionary principles (Daly and Wilson, 1978). Here, we shall argue that the same theoretical perspective provides an interpretive framework for a number of facts about parental behavior and the circumstances under which it breaks down.

Human matings are predominantly monogamous in virtually all cultures (although a minority of wealthy, powerful men are polygamists in most societies). Women are primarily responsible for the direct care of infants in every society, but some form of male investment in children is also universal. Men are generally breadwinners and also usually confer status and resources on offspring, especially sons (Murdock, 1967). In one sample of 23 societies, men shared in direct infant-care activities in 13 (Stephens, 1963). In our own society, men make various contributions as material providers, protectors, participants in education, discipline and play, and less often feed, clothe and bathe children (Lopata, 1965; Benson, 1968; Fein, 1976; Parke and Sawin, 1976; Araji, 1977; Stafford *et al.*, 1977). Biparental care in *Homo sapiens* appears to be a fundamental adaptive attribute, as indicated by its cross-cultural universality, and by the social and intellectual disadvantages and the greater post-natal mortality suffered by fatherless children (Crellin *et al.*, 1971).

But, if investment of time and resources in the rearing of children on the part of both women and men is characteristic of *Homo sapiens* and has been so for a significant portion of our evolutionary history, nevertheless the parental strategies of the two sexes are necessarily different. In people, as in other animals, an adult's inclination to make a substantial investment in a child is not expected to be indiscriminate with respect to the child's biological parenthood. Women, like other female mammals, become selectively attached to their young at birth, a process considered further below. This neonatal attachment process is a virtually foolproof mechanism for assuring that a mother's nurture goes to her own child. Males, by contrast, are readily deceived about paternity, and as we noted earlier, "paternity confidence mechanisms" are requisites for the evolution of a male parental role. In our own species, male sexual jealousy and various

forms of sequestering and guarding women serve this function (Dickemann, n.d.).

This sex difference in susceptibility to parental misidentification underlies cross-culturally consistent double standards in penalties for adultery, in divorce laws, and in the importance attached to premarital chastity. For the sake of paternity confidence, men strive to control the sex lives of women. The issue of paternity arises with each conception. Whenever the male has strong grounds to doubt paternity, he may withhold parental investment. As in other species, a man may desert his mate altogether or he may kill the offspring. Kinsey *et al.* (1953) demonstrated a disproportionate emphasis on female sexual fidelity as a cause of divorce in America: 51 percent of divorced men cited extramarital coitus by their spouses as a major factor in their divorces, compared to just 27 percent of divorced women, despite the fact that the men were twice as likely as the women to have committed adultery. Moreover, the incidence of divorce is especially high when the woman was pregnant before marriage (Christensen and Meissner, 1953), and although a number of factors may be involved, including immaturity and lack of adequate economic assets, the degree of paternity confidence appears to be a contributing factor.

PARENTAL ATTACHMENT

A mother can establish an individualized bond with her child at birth, and pretechnological birth practices guaranteed near-perfect maternity confidence. Hospital practices, however, seldom permit the puerperal mother-infant attachment process to proceed normally (Sugarman, 1977). Recent research indicates that these practices may be profoundly disruptive.

Lozoff *et al.* (1977) have reviewed six separate studies involving over 500 primiparous women in four countries, all of which have demonstrated effects of slight modifications of hospital routines shortly after birth upon mother-infant interaction. In each of these studies, a control group of mothers was treated routinely (allowed to see the child at birth, prevented from physical contact for 6-12 hours, and then given the child only for scheduled feedings), while an experimental group was allowed close physical contact within minutes after birth and approximately 25-50 percent more contact time during two

to seven days of hospitalization. As early as the second postpartum day, experimental mothers handled their infants differently from the controls. Follow-up studies one month, three months, one year and two years later showed effects upon the behavior of both mothers and children. Experimental mothers spoke to their infants more, handled them more affectionately, looked them in the eye more, and expressed stronger feelings of maternal attachment (Klaus and Kennell, 1976).

Observations of mothers with infants immediately after delivery provide clues about the nature of their interactions which make the experience so salient to the mother and so important in establishing individualized attachment. The mother orients so that she is "en face" with the infant and gazes intently at the infant's face (Klaus *et al.*, 1975). Within the first hour after birth the infant exhibits precocious neonatal responses including eye contact, visual attentiveness and following, and attentiveness to human speech sounds (Robson, 1967; Goren *et al.*, 1975; Condon and Sander, 1974). After having had close physical contact with their infants over the first few days, mothers report developing a feeling that the child is special and wonderful (Kennell *et al.*, 1975). Mothers who have not had this opportunity with their child immediately postpartum, because of birth complications, low birth weight of infant or caesarian delivery, for example, frequently report feeling emotionally detached from the child (Kennell *et al.*, 1975; Klaus and Kennell, 1976). The normal consequence of this maternal attachment process throughout the evolutionary history of our species has presumably been the rapid development of a bond of discriminative maternal solicitude.

Assumption of a maternal role in the absence of early attachment experiences can be difficult. According to a Cleveland study (Duberman, 1975), for example, only 25 percent of stepmothers could claim "maternal feelings" for their stepchildren. By contrast, 53 percent of stepfathers were able to claim "paternal feelings." One possible interpretation of this difference is that the profession of "maternal feelings" may imply a more profound emotional attachment than "paternal feelings."

Paternal attachment has received little research attention, but there are indications that presence at the birth and early contact

with the infant can facilitate the development of paternal feeling (Lind, quoted in Klaus and Kennell, 1976). From our evolutionary perspective, however, we should expect paternal attachment to be relatively strongly influenced by cognitive considerations bearing on paternity confidence. These include, for example, perceived similarity of the child to the alleged father and his confidence of his wife's sexual fidelity.

CHILD ABUSE AND NEGLECT

Where parental feeling is weak, the risk of parental mistreatment is exacerbated. This is not to deny that the factors contributing to the abuse and neglect of children are various and complex (*e.g.*, Parke and Collmer, 1975; Helfer and Kempe, 1976; Martin, 1976; Burgess and Conger, 1978), but merely to assert that the strength of specific parental attachment to the child in question is one of a constellation of interactive determinants of the probability that a particular child will be mistreated.

The suggestion that enhancing mother-infant bonding during the postpartum period will mitigate the risk of later abuse gains strong support from a recent experimental study by O'Connor *et al.* (n.d.). Low-income primiparous mothers were randomly assigned to a "hospital routine" condition or to an experimental condition allowing an additional six hours of mother-infant contact on each of the first two postpartum days. In follow-up studies in the second year, nine of 143 "hospital routine" children were categorized as victims of abuse, neglect, abandonment, or nonorganic failure to thrive, compared to none of the 134 experimental children. This constitutes a highly significant ($p = .0023$, Fisher exact test) reduction in the risk of parental mistreatment as a result of just 12 extra hours of contact in the first two days after birth.

As might be expected from the above results, children excessively separated from their mothers, for whatever reasons, during the neonatal period are a high-risk group for abuse and neglect. Lynch (1975), for example, found that 40 percent of a sample of severely abused children had been separated from their mothers during the first 48 hours after birth compared to just 6 percent of their nonabused siblings. In this and other studies (with the important exception of the O'Con-

nor experiment), neonatal separation is confounded with other variables, such as prematurity and birth defects, which may contribute to abuse risk in their own right. Premature and defective children are indeed a high-risk group (reviewed by Daly and Wilson, in press), and it is probably the case that both neonatal separation and more direct consequences of the infants' conditions are important. The latter include weakened maternal attachment as a result of the lack of infantile responsiveness associated with some defects (e.g., Fraiberg, 1974) and, in extreme cases, revulsion for and rejection of the defective child (Fletcher, 1974; Hood, 1976; Drotar *et al.*, 1975; Irvin *et al.*, 1976).

The present perspective suggests that the risk of abuse and neglect is likely to be exacerbated where substitute individuals fill the roles of biological parents. In the United States in 1976, children living with one natural and one stepparent were 2.2 to 6.9 times (age-specific rates) as likely to be abused as children living with two natural parents, and 1.1 to 4.1 times as likely to be neglected (Daly and Wilson, in press; Wilson *et al.*, in press). Limited evidence suggests that the incidence of steprelationships is uncorrelated with income level, and therefore that the correlation between socioeconomic status and abuse/neglect risk probably cannot account for the stepparent effect (Wilson *et al.*, in press). With presently available data, we cannot separately estimate the risks in stepmother and stepfather households.

ADOPTION

The very occurrence of adoption and fostering of children to parent substitutes testifies that human parental solicitude need not be exclusively directed to own children. Superficially, adoption seems anomalous within the evolutionary framework espoused above, but a consideration of its features may reverse this impression.

It may first be worthwhile to consider adoption historically and crossculturally, since the modern practice of adoption in Western countries has certain unusual features. Adoption is practiced in many traditional societies and is common in several. Its functions and precipitating circumstances are various, but one general characteristic must be stressed: the adoptive parents are usually close biological relatives of the adoptee.

Adoption is very frequent in Oceania for example (Carroll, 1970; Brady, 1976), where 85 percent of 317 Hawaiian cases (Howard *et al.*, 1970), 83 percent of 52 Manihi cases (Brooks, 1976), 85 percent of 62 Kusaie cases (Wilson, 1976), 98 percent of 81 Tongan cases (Morton, 1976) and 91 percent of 57 Trukese cases (Goodenough, 1970) involved blood relatives. Similarly, Inuit adopt frequently and 91 percent of 68 adoptions at Pond Inlet were of biological relatives (Rousseau, 1970). In parts of China, adoption of an heir was imperative for men without sons; the adoptee was prescribed to be the nearest available kin in the patrilineal line (Yang, 1948). It is not generally appreciated that a substantial proportion of adoptions in America still involve relatives: only 34.9 percent of adoption petitions granted in the U.S. in 1975, for example, involved nonrelatives, while 57.2 percent were adoptions by stepparents and/or natural parents, and 7.9 percent adoptions by other relatives (National Center for Social Statistics, 1977; the reporting base includes 29 states and the District of Columbia, comprising 59.3 percent of the U.S. population).

A second prevalent feature is that adoptive parents commonly lack children of their own, or lack children of the desired sex. Childlessness is the most common factor invoked by adoptive parents to explain their actions in several Oceanic studies (Carroll, 1970; Brady, 1976). Couples in many societies may adopt the son or daughter required to perform sex-typed services of hunting or housekeeping, particularly in anticipation of the parents' old age. Acquisition of an heir was the only justification for adoption in many developing civilizations. Roman law permitted full adoption only to the childless, and this rule persists by direct descent in Spain, Italy and Portugal to this day. In Portugal, an adoption can be reversed and the adoptee disinherited if the adoptive parents subsequently have their own child; an identical provision was found in Hindu tradition (Benet, 1976). In our own society, an increase in adoptions on the part of couples with children of their own is a recent phenomenon, but adoption is still primarily a recourse of the infertile (Bonham, 1977).

Those who relinquish children for adoption have always been the young, the unmarried and those unable to care for them. Nine of 64 Inuit adoptees were the illegitimate children

of young girls whose relatives adopted them; 17 more were born within two years of an older child which the mother kept while giving up the infant (Rousseau, 1970). Among Rotumans, the natural parents of more than half of 151 adoptees were unmarried, divorced or dead (Howard, 1970). In both of these societies and in others, the maternal grandparents are the most frequent adopters. In certain cases, when a woman takes a new husband who is reluctant to rear her earlier children, she may give them to her parents or other relatives for adoption. Among American adoptions by unrelated petitioners in 1975, 68 percent of adoptees were born out of wedlock, a further 10.2 percent came from broken marriages, and another 3.1 percent had lost one or both natural parents by death (National Center for Social Statistics, 1977).

Several widespread features of human adoption described above—the relinquishment of children by those least able to care for them, the tendency for adoption to involve biological relatives, and the prevalence of postreproductive and otherwise infertile adopters—all match expectations from evolutionary theory. The first of these features is to be expected from the fact that selection favors parents (especially young parents with future reproductive prospects) saving themselves first and the offspring second when threatened by resource shortages. Abandonment (or infanticide) is a common recourse of both human and nonhuman parents incapable of providing for the young without endangering themselves or older young (see *e.g.*, Dickeman, 1975; O'Connor, 1978).

The second noteworthy feature of human adoption is its kin-preferential tendency. The link between this feature and evolutionary theory is the concept of kin selection: where feasible, natural selection promotes preferential treatment of relatives over nonrelatives, and parental solicitude is only a special case of this more general benevolence toward relatives (see *e.g.*, West-Eberhard, 1975). It is only in species with complex social organizations that such nepotistic benevolence is likely to extend beyond the parent-child relationship to include siblings, grandparents, aunts and others (*e.g.*, Woolfenden, in press; Kurland, 1977). Such relatives supplement parental contributions to the welfare of the young and, sometimes, especially when

parents die while the young are still dependent, “adopt” (*e.g.*, Van Lawick-Goodall, 1968). For any mammalian species, such as our own, which habitually lives in groups of closely-related individuals, it may be supposed that natural selection will favor some general benevolence toward the young of the group; that is to say a partial relaxation of the extremely discriminatory parental behavior that characterizes some other mammals such as goats.

Third, consider the fact that adopters are most commonly postreproductive or otherwise infertile. When one has parental resources (including food, protection, tutelage, etc.) to allocate, kin selection theory predicts that no other recipient should be favored over one's natural offspring. Parental resources should therefore be allocated to other young only when own offspring are not identifiable (*e.g.*, Kurland, 1979), not in need (for example fully grown and independent) or nonexistent. Adoption is a “low-cost” act for the infertile adopter in the sense that it does not entail withdrawal of resources from own young. Under such circumstances, adoption of more distantly related young may be selectively favored.¹

We wish to stress that the above discussion is primarily concerned with selective circumstances which we hypothesize to have played a role in the evolution of adoptive inclinations. If kin selection, for example, has indeed been a force in the evolution of human willingness to adopt, this does not necessarily imply that knowledge of kinship will be a direct factor in psychology of potential adopters. Successful adoption can be facilitated to the extent that parental attachment experiences similar to those following upon natural childbirth are achieved; in a sense this entails “tricking” psychological mechanisms whose evolved function is to direct parental feeling discriminatively to own offspring.

¹In species lacking complex kinship networks, adoption cannot be selective with respect to relatedness and yet may occur. Lactating elephant seals whose pups are killed, for example, may adopt alien pups. In so doing, they serve their own reproductive interests not by rearing kin, but by a direct physiological consequence of the adoption: a completed lactation is evidently necessary in the hormonal causal chain that will bring the mother into estrus and enable her to become pregnant with *next* year's pup (LeBoeuf *et al.*, 1972).

DIFFERENTIAL TREATMENT OF OWN OFFSPRING

Even in the absence of differential relatedness, when young are all natural offspring, the best parental strategy may involve inequities. There are at least three types of circumstances in which parents may be expected to discriminate against some of their own offspring while favoring others—too many young to raise, variations in the quality (viability, fertility, etc.) of young, and social and economic circumstances favoring the concentration of parental investment in one or a few offspring. We discuss each of these briefly below.

The animal behavior literature contains many examples, especially among birds, in which parents can rear a limited number of young and in which efforts to raise more risk starvation for all (Lack, 1966). One parental strategy in such cases is to first feed those who beg most strenuously, that is, the largest and healthiest, and to only feed runts when others are sated (see, *e.g.*, Skutch, 1976). In such cases, all are reared only when resources are abundant. In hard years, broods are soon culled to manageable numbers with a minimal wastage of parental effort (especially if dead runts are cannibalized by siblings). In the case of people, in the hunting-and-gathering eco-niche characteristic of our evolutionary history, lactational anovulation functions to maintain birth-spacing of several years and hence to avoid maternal overburdening (*e.g.*, Howell, 1976; Harpending, 1976). This mechanism is furthermore sensitive to maternal nutrition and hence allows mothers to space babies flexibly according to their capacity to feed them (Frisch, 1978; Knodel, 1977). Nevertheless, birth-spacing mechanisms cannot entirely eliminate detrimental competition for maternal resources between successive infants (Daly and Wilson, 1978:285-287), and human mothers sometimes find themselves overtaxed. Births in too rapid succession constitute a major motive for giving up children for adoption when willing adopters are available (*e.g.*, Rousseau, 1970; Carroll, 1970) and for infanticide when they are not (*e.g.*, Sakuta and Saito, n.d.; Dickeman, 1975).

From the view of parental solicitude as adaptively variable, one might also anticipate that offspring with imperfections predictive

of poor survival or reproductive prospects would be likely victims of neglect and infanticide (Daly and Wilson, in press). This is clearly the case in some animal studies (*e.g.*, Hoogland and Sherman, 1976) and infanticide against defectives has been routinely practiced in several human societies (see Dickeman, 1975). Where societal values insist that parents rear defectives, the circumstance is one with a high risk of failure of parental solicitude and hence of child abuse (*e.g.*, Smith and Hanson, 1974; Hunter *et al.*, 1978).

Finally, it sometimes behooves parents to concentrate investment in one or a select few offspring. Such differential treatment is particularly prevalent with respect to the sex of the offspring. In many species, males are more variable in their reproductive success than females: some males monopolize many breeding females and sire many young while others die without issue. It follows that male reproductive success often continues to increase as the resources controlled by the male increase, whereas female reproductive success has a lower physiological ceiling, is less variable and profits less from wealth. It is, therefore, often an effective parental strategy for the maximization of grandchild production, to concentrate resources in sons rather than in daughters. Hartung (1976) has suggested that this is part of the reason why inheritance is overwhelmingly male-preferential, and Dickemann (1979) has suggested that this is why female-selective infanticide is especially prevalent in the higher classes of stratified polygamous societies. A circumstance in which resources may be concentrated in daughters is that of "dowry competition" among families vying to marry their daughters to scarce high-status men (Dickemann, in press). Parental investment may also be differential within sexes. Some resources, such as the family farm, are best kept intact rather than divided equally. A common solution to this problem is primogeniture, inheritance by a single senior son.

CONCLUDING REMARKS

Discriminative parental solicitude is a fact. In the above discussion, we have tried to provide a theoretical explanation for its existence within the framework of evolutionary biology. Such an approach complements, rather than competes with, other theoretical

perspectives within the social sciences. In suggesting how parents "should" or "are expected to" behave, we are not making value judgments. Rather we are suggesting what characteristics of parental psychology might be anticipated insofar as that psychology is a product of evolution by natural selection.

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The *Journal of Family Issues* announces that it will be publishing a special issue on "Dual-Worker Families" to appear June, 1981. The Guest Editor will be Joan Aldous, University of Notre Dame. She is looking for papers on such subjects as the following: family roles and organization in dual-earner families; their relationships with kin, the economy and other extra-familial groups and institutions; trends in their incidence, divorce rates and other indicators of family dynamics; and varying types of dual-earner families (commuter families, etc.). Persons doing work in these or other relevant areas are encouraged to submit manuscripts no later than September, 1980 to Joan Aldous, Department of Sociology and Anthropology, University of Notre Dame, Notre Dame, IN 46556.